CLAIMS

1. A method for determining a load exerted on a tyre fitted on a vehicle during a running of said vehicle on a rolling surface, the method comprising the following steps:
   - acquiring a first signal comprising a first portion representative of a radial deformation to which a first tread area portion of said tyre is subjected during passage of said first tread area portion in a contact region between said tyre and said rolling surface;
   - measuring an amplitude of said radial deformation in said first signal portion;
   - estimating a rotation speed and an inflation pressure of said tyre corresponding to said radial deformation;
   - deriving said tyre load from said amplitude, said rotation speed and said inflation pressure.

2. A method according to claim 1, characterized in that said first signal comprises a radial acceleration signal.

3. A method according to claim 1 or 2, characterized in that said step of measuring said amplitude comprises measuring a difference between a maximum value of said first signal and a minimum value of said first signal in said first signal portion.

4. A method according to any one of the previous claims, characterized in that said method further comprises, before said step of measuring said amplitude, a further step of low-pass filtering said first signal.

5. A method according to any one of the previous claims, characterized in that said step of estimating said rotation speed of the tyre comprises measuring an average value of said first signal in a second signal portion, outside from said first signal portion.

6. A method according to any one of claims 1 to 4, characterized in that said step of estimating said rotation speed of the tyre comprises measuring an average value of said first signal in a whole turn of said tyre.

7. A method according to any one of the previous claims, characterized in that it further comprises a step of acquiring a second signal representative of a radial acceleration to which a second tread area portion of said tyre is subjected.

8. A method according to claim 7, characterized in that said step of estimating said rotation speed of the tyre comprises measuring a value of said second signal during said passage of said first tread area portion in said contact region between said tyre and a rolling surface.

9. A method according to any one of the previous claims, characterized in that it further comprises, before said step of measuring said amplitude, a further step of sampling said first signal at a frequency of at least 5 kHz.

10. A method according to claim 9, characterized in that said step of sampling is carried out at a frequency of at least 7 kHz.

11. A method according to any one of the previous claims, characterized in that it further comprises the step of providing characteristic functions describing an expected radial deformation amplitude versus rotation speed, corresponding to predetermined conditions of tyre load and inflation pressure.

12. A method according to claim 11, characterized in that said characteristic functions comprise polynomial functions.

13. A method according to claim 11 or claim 12, characterized in that said step of deriving said tyre load comprises:

- identifying a set of characteristic functions corresponding to said estimated inflation pressure;
- determining, from said set of characteristic functions, a corresponding set of expected radial deformation amplitudes corresponding to said estimated rotation speed.

14. A method according to claim 13, characterized in that said step of deriving said tyre load further comprises:
    - comparing said measured radial deformation amplitude with any one of said set of expected radial deformation amplitudes, in order to identify a closer expected radial deformation amplitude;
    - determining said tyre load based from said closer expected radial deformation amplitude.

15. A method of controlling a vehicle having at least one tyre fitted thereon, comprising:
    - determining a load exerted on said tyre by a method according to any one of the previous claims;
    - passing said determined load to a vehicle control system of the vehicle;
    - adjusting at least one parameter in said vehicle control system based on said determined load.

16. A method according to claim 15, characterized in that said vehicle control system comprises a brake control system, and in that said step of adjusting at least one parameter comprises adjusting a braking force on said tyre.

17. A method according to claims 15 or 16, characterized in that said vehicle control system comprises a steering control system, and in that said step of adjusting at least one parameter comprises selecting a maximum variation allowed from steering commands.

18. A method according to any one of claims 15 to 17, characterized in that said vehicle control system comprises a suspension control system, and in that said step of adjusting at least one parameter comprises adjusting a stiffness of a suspension spring associated to said tyre.

19. A method according to any one of claims 15 to 18, characterized in that said vehicle comprises at least one tyre fitted on its right and at least one tyre fitted on its left, said vehicle control system comprises an active roll control system, and in that said step of adjusting at least one parameter comprises

compensating an unequal load distribution between said left fitted tyre and said right fitted tyre.

20. A system for determining a load exerted on a tyre fitted on a vehicle during a running of said vehicle on a rolling surface, the system comprising:

- a measuring device adapted to acquire a signal representative of a deformation to which a first tread area portion of said tyre is subjected during passage of said first tread area portion in a contact region between said tyre and said rolling surface;
- a pressure sensor adapted to sense an inflation pressure of said tyre;
- a device for estimating a rotation speed of said tyre;
- at least one processing unit being adapted to determine an amplitude of said radial deformation in said first signal portion, and to derive said tyre load from said amplitude, said rotation speed and said inflation pressure.

21. A system according to claim 20, characterized in that said measuring device comprises a radial accelerometer.

22. A system according to claim 20 or claim 21, characterized in that said measuring device comprises a sampling device adapted to sample said signal at a frequency of at least 5 kHz.

23. A system according to claim 22, characterized in that said sampling device is adapted to sample said signal at a frequency of at least 7 kHz.

24. A system according to any one of claims 20 to 23, characterized in that it further comprises at least one memory associated to said processing unit.

25. A system according to claim 24, characterized in that said at least one memory comprises pre-stored characteristic functions describing an expected radial deformation amplitude versus rotation speed, corresponding to predetermined conditions of tyre load and inflation pressure.

26. A system according to claim 25, characterized in that said functions comprise polynomial functions.

27. A system according to any one of claims 24 to 26, characterized in that said at least one memory comprises pre-stored instructions for said processing unit.

28. A system according to claim 27, characterized in that said pre-stored instructions comprise at least a first set of instructions being adapted to:
- identify a set of characteristic functions corresponding to a sensed inflation pressure;
- determine, from said set of characteristic functions, a corresponding set of expected radial deformation amplitudes corresponding to said estimated rotation speed.

29. A system according to claim 28, characterized in that said pre-stored instructions comprise at least a second set of instructions being adapted to:
- compare said determined radial deformation amplitude with any one of said set of expected radial deformation amplitudes, in order to identify a closer expected radial deformation amplitude;
- determine said tyre load based from said closer expected radial deformation amplitude.

30. A system according to any one of claims 20 to 29, characterized in that said measuring device is included in a sensor device located in a tread area portion of said tyre.

31. A system according to claim 30, characterized in that said sensor device is disposed substantially in correspondence of an equatorial plane of the tyre.

32. A system according to claim 30 or 31, characterized in that said sensor device is secured to an inner liner of the tyre.

33. A system according to claim 32, characterized in that it comprises a damping element between said sensor and said inner liner.

34. A system according to any one of claims 30 to 33, characterized in that said sensor device further includes a transmitting device.

35. A system according to claim 34, characterized in that said transmitting device is operatively connected to a first antenna.

36. A system according to any one of claims 20 to 35, characterized in that it further comprises a filtering device adapted for low-pass filtering said signal.

37. A system according to any one of claims 30 to 36, characterized in that said sensor further comprises a power source.

38. A system according to claim 37, characterized in that said power source comprises a battery.

39. A system according to claim 37, characterized in that said power source comprises a self-powering device, being adapted to generate electrical power as a result of mechanical stresses undergone by said sensor device during running of said vehicle.

40. A system according to claim 39, characterized in that said self-powering device comprises a piezoelectric element.

41. A system according to claim 39 or 40, characterized in that said self-powering device comprises an electrical storage circuit.

42. A system according to claim 41, characterized in that said electrical storage circuit comprises a resistor and a capacitor.

43. A system according to any one of claims 30 to 42, characterized in that said processing unit is included within said sensor device.

44. A system according to any one of claims 30 to 43, characterized in that it further comprises a fixed unit located on the vehicle, comprising a receiving device for receiving data from said sensor device.

45. A system according to claim 44, characterized in that said receiving unit comprises a second antenna.

46. A system according to claims 35 and 45, characterized in that said first antenna and said second antenna are adapted for data transmission at a frequency comprised between 400 and 450 MHz.

47. A system according to any one of claims 20 to 46, characterized in that said device for estimating the rotation speed of said tyre is said processing unit.